Does prosodic similarity matter in L2 production? The case of Korean learners of French

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Abstract

French and Korean share similar prosodic characteristics as far as rhythm and intonation are concerned. In order to determine how this prosodic similarity affects the second language production, we propose in this paper to examine these prosodic parameters in read productions by Korean learners of French as a second language compared to French native speakers. We show that the productions of Korean learners and French native speakers present minor differences: concerning rhythm, Korean learners are less systematic in lengthening the last vowel at a phrase-final position while the overall pitch contour is similar for both groups of speakers, especially for the subject and object phrases. We argue that these minor differences are not sufficient enough for the detection of a "foreign accent" only with prosodic cues.

Keywords: Second Language, prosody, rhythm, intonation, French, Korean, Speech production

1. Introduction

In the last years, several studies have shown that the types of errors made by second language (L2) speakers depended on whether phonological categories were similar or different in both First (L1) and Second (L2) languages (see Best 1995, Flege 1995 among others for the segmental component). As far as the prosodic level is concerned, studies on intonation (Jilka 2007, Mennen 2007) and rhythm (Barry 2007) have shown that when the intonational contour or rhythmic pattern exists in both languages, if the distinct features are minor, speakers are more prone to making mistakes.

The present study focuses on the prosodic components of production in French by Korean native speakers. French and Korean are both described as "syllable-timed" languages (Di Cristo 1999, Jun 1993), with common prosodic features: (1) Primary stress, realized through syllabic lengthening, is located on the last syllable of the last lexical word of a phrase (among others Martin 2009, Di Cristo 1999 and Jun 1993), (2) non-stressed syllables have a constant duration (Di Cristo 1999, Lee 1993), and (3) declarative sentences have a descending pitch contour beginning on the first accented syllable in French (Di Cristo 1999) and on the sentence's second syllable in Korean (Lee 1990) and continuing through the end of the sentence. Furthermore, the intonation of modality is seen as the result of F0 realization at IP-final level both in French (Delattre 1966, Martin 2009) and Korean (Jun 1993).

This quick comparison of the prosodic structure of the two languages reveals their prosodic similarity. In this paper, we present the results of a production experiment which aims at understanding how rhythm and intonation of native Korean speakers translate into French, and examining if there are enough cues in L2 realizations to consider the existence of a Korean foreign accent in French based on rhythm and intonation only.

2. Production experiment

In this section, we present the experimental protocol of our production experiment, followed by the results we obtained.

2.1. Method

2.1.1. Participants

All speakers were students living in Seoul at the time of the recordings: Two female native speakers of Standard Parisian French (19 and 20 years old) and three female (23, 23 and 26 years old) and one male (23 years old) native speakers of Standard Seoul Korean, with variable proficiency levels in French.

2.1.2. Corpus

Since our aim was to compare the prosodic characteristics of two groups of speakers, we chose to work on a read corpus, which allowed keeping the same segmental information for both groups while avoiding differences due to hesitations or lexicon and syntax.

Declarative sentences were designed in French following the pattern "NP_{Subj}-VP-NP_{Obj}". All sentences are balanced: in each sentence, the three phrases (NP_{Subj}, VP and NP_{Obj}) have an identical number of syllables, varying from 1 to 10 syllables: there are two sentences of 3 times 1 syllables, two sentences of 3 times 2 syllables, two sentences of 3 times 3 syllables, etc. up to 3 times 10 syllables. Our corpus contains a total of 20 sentences. (1), (2) and (3) and sample examples of the corpus, in French, with English translation:

(1) 3x2 (6 syllables) sentence
(le chat)$_{SUBJ}$ (a bu)$_{VP}$ (le lait)$_{OBJ}$
(the cat)$_{SUBJ}$ (drank)$_{VP}$ (the milk)$_{OBJ}$
(2) 3x4 (12 syllables) sentence
(Les deux garçons)$_{SUBJ}$ (ont rencontré)$_{VP}$ (un vieil ami)$_{OBJ}$
(The two boys)$_{SUBJ}$ (met)$_{VP}$ (an old friend)$_{OBJ}$
(3) 3x9 (27 syllables) sentence
(Le voyageur perdu en Corée)$_{SUBJ}$ (a eu l'occasion d'utiliser)$_{VP}$ (son dictionnaire français-coréen)$_{OBJ}$
(The lost traveler in Korea)$_{SUBJ}$ (was able to use)$_{VP}$ (his French-Korean dictionary)$_{OBJ}$

2.1.3. Recordings

Recordings were made with the Audacity software (Audacity Version 2.0), in mono, using a sampling frequency of 22050 Hertz and 32bits. All recordings were done on a laptop, using an external microphone, in a quiet room.

The twenty sentences of the corpus were read five times in a random order. The order was different for each series of sentences. All speakers read the five series of sentences in the same order, with pauses between each series. The recordings

were made without any time constraint. Speakers read the sentences before the recording session, and could ask for explanation if they had trouble understanding the meaning of the sentences. They were allowed to take breaks whenever they wished and to re-read sentences if they faced difficulties.

2.1.4. Data analyses

The corpus was segmented and annotated using Praat (Boersma & Weenink, 2013). The annotation was first made automatically using the Easyalign software (Goldman 2011) and verified manually.
Segment durations and F0 values of vowels in phrase-final syllables were automatically extracted using a Praat script.
For rhythm, we chose the vowel over the syllable as the unit of analysis. Vocalic durations were normalized in order to put aside "inter-speaker" and "intra-speaker" variations: instead of comparing raw durations, we used a ratio of the duration of each occurrence produced by the speaker divided by the mean duration of this type of vowel in this speaker's corpus.
F0 values were measured at three points per vowel: at the beginning, middle and end. In order to avoid "inter-speaker" variation, the data were normalized in semi-tones calculated using each speaker's mean F0, using the following formula (1) from (Martin 2009):

$$F0(ST) = 12*(\text{Log}(F0/\text{speaker's\_meanF0}))/\text{Log}(2.00) \quad (1).$$

We ran ANOVA tests in order to compare phrase-final vocalic durations and phrase-final F0 modulations of the two groups (L1 and L2). We used regression tests to study the difference in realization of the declination line over sentences by the two groups. Statistics were run on the R software (R Development Core Team 2012).

3. Results

3.1. Rhythm

The study of rhythm consisted in measuring the presence or absence of vocalic lengthening in a given position. For the final vowel of each phrase (subject, verb and object), we set that a vowel can be considered as lengthened when its normalized duration is above the threshold of 1.2 (mean + 20%). We considered that choosing the mean duration value was not sufficient enough to determine a lengthening compared to the threshold of 1.2, above which lengthening can clearly be perceived. ANOVA tests were conducted for every sentence, but because of limits of space, we show the results for three sentences only, illustrating our purpose. Figure 1 shows the variation of mean vocalic durations for the two groups of speakers (French L1 and Korean L2) for three sentences (3x2=6, 3x4=12 and 3x9=27 syllables).
In most cases, both French L1 speakers and Korean L2 learners lengthen the last vowel of the subject phrase. French speakers almost never lengthen the end of a verb, which shows that they tend to group the verb with its object and to place lengthening only at the end of the sentence. Korean speakers present more diverse results, with vocalic lengthening found in six cases out of ten (sentences with 3x4, 3x5, 3x6, 3x7, 3x8, 3x10 syllables), which might correspond to a more frequent segmentation of the sentence for learners than for native speakers. Vowels at the end of object phrases (which represents also the end of sentences) are systematically longer for French speakers while Korean learners do not produce this expected lengthening (vocalic lengthening of 1,2 can be seen only for sentences with 3x2, 3x4 and 3x10 syllables).
We ran ANOVA tests to compare the realizations of vowels at the end of phrases for the two groups of speakers. Thus, for 3x2 syllable sentences, durations are similar for both groups of speakers, with a lengthening of the 2nd vowel (Subject-final syllable), of the 4th vowel (verb-final syllable) and of the 6th vowel (Object and sentence final syllable). The difference of lengthening is significant for both groups for each position (for the 2nd vowel, ($F(1,57) = 4,380$ $p=.0408$), for the 4th syllable ($F(1,55) = 1,113$ $p=.0001$) and the 6th vowel ($F(1,55) = 17,378$ $p=.0001$)).
For 3x4 syllable sentences, the two groups have a different realization of lengthening: no lengthening of the 4th and 8th vowels (subject-final and verb-final syllables) but lengthening of the 12th vowel (sentence-final syllable) for the French speakers an moderate lengthening of the 4th, 8th and 12th vowels for the Korean speakers. The ANOVA tests show significant differences between the two groups for the three vowels: for the 4th vowel $F(1,54) = 9,863$ $p=.0027$, for the 8th vowel $F(1,54) = 16,118$ $p=.0002$ and for the 12th vowel $F(1,54) = 14,353$ $p=.0004$. However these results differ from the predicted results, since the group of Korean speakers and not the group of French speakers shows a systematic vocalic lengthening in phrase-final syllables for each phrase (subject, verb and object).
For the 3x9 syllable sentences, there is a lengthening of only the 9th vowel by French speakers and of the 9th and 11th vowels by the Korean speakers. The differences between the two groups for the 9th and 18th vowels are not significant, contrarily to the difference between the two groups on the sentence-final vowel which is significant ($F(1,48) = 18,292$ $p<.0001$).

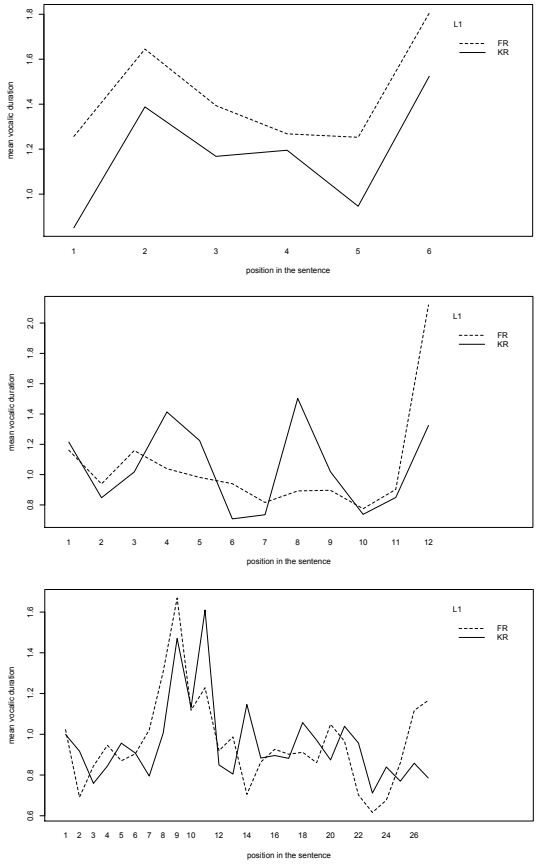

Figure 1: *Mean vocalic duration of the two groups for 3x2, 3x4 and 3x9 syllable sentences.*

3.2. Intonational patterns at phrase-final level

For intonation, the F0 values for the last vowel of each phrase (subject, verb and object) were compared for the two groups of

speakers. Results show that the two groups (French native speakers and Korean learners of French) produce very close patterns. Figure 2 illustrates the differences and similarities of the F0 measures for the two groups of speakers (French L1 and Korean L2 speakers) for three sentences (3x2=6, 3x4=12 and 3x9=27 syllables).

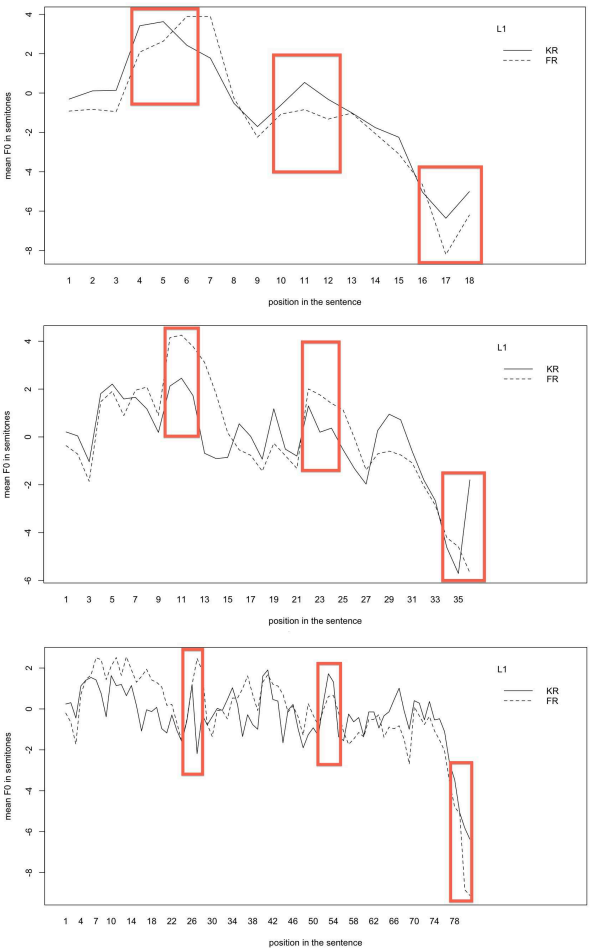

Figure 2: *Mean F0 of the two groups for3x2, 3x4 and 3x9 syllable sentences.*

Thus, at the end of sentences (i.e. at the end of object phrases), both French and Korean speakers produce massively a falling pattern (sentences 3x2, 3x3, 3x6, 3x8, 3x9, 3x10), which can be followed by a small rising (sentences 3x2, 3x6, 3x8). Korean learners have more random productions with more final risings, and even a rising pattern for sentence 3x7. However, the ANOVA test reveals a non-significant difference for F0 realizations of the two groups of speakers on the last vowel of the sentence.

The F0 realization on the last vowel of the subject is also similar for both groups. However, the type of pattern can vary, with a fall-rise pattern for sentence 3x1, a rising pattern for 3x5, 3x6 and 3x10 syllable sentences, and a falling pattern for the 3x7 syllable sentence. The realizations of the two groups of speakers differ for sentences with 3x2, 3x3, 3x8 and 3x9 syllables.

Results are less homogeneous at the end of verb groups. Within the group of French speakers, the last vowel at this position is produced as a flat pattern in short sentences (3x1 and 3x2 syllables), a rising pattern in sentences with 3x3, 3x7 and 3x9 syllables, a rise-fall pattern in sentences 3x5 and 3x10 and a falling pattern in sentences 3x4, 3x6 and 3x8. Korean learners realize also the same patterns but not for the same sentences: rising pattern is found in sentences 3x3, 3x5 and 3x7, a flat pattern in sentences 3x1 and 3x8, a rise-fall pattern in sentences 3x2, 3x9 and 3x10, a falling pattern in sentence 3x4, and a falling pattern followed by a rise in sentences 3x6.

For 3x2 syllable sentences, the realizations of the two groups are very close, with significant differences at only two points ($F(1,55) = 12{,}056$ $p=.0010$) at subject-onset point and vowel mid-point at verb-final level ($F(1,57) = 19{,}818$ $p<.0001$).

For 3x4 syllable sentences, the two groups have a different realization of F0 patterns: flat F0 declination for French L1 speakers and peak pattern for Korean learners on the subject final vowel with significant differences on F0 values on the subject final vowel ($F(1,36) = 6{,}306$ $p=.0168$) at vowel-onset, ($F(1,54) = 7{,}740$ $p=.0074$) at mid-point and ($F(1,36) = 4{,}514$ $p=.0405$) at end-point) and at end-point of the verb-final vowel ($F(1,12) = 4{,}890$ $p=.0472$).

For 3x9 syllable sentences, both groups have similar realization of F0 patterns at verb and object level, but different at subject level: French L1 speakers have a rising pattern and Korean learners have a rising-falling pattern, with a significant difference at end-point of the subject-final vowel ($F(1,22) = 9{,}172$ $p=.0062$). At verb-final level, the group of French speakers have a rising F0 pattern whereas the Korean learners have a rising-falling pattern, with a significant difference between both groups at mid-point ($F(1,47) = 5{,}895$ $p=.0191$) and at end-point ($F(1,29) = 5{,}582$ $p=.0251$). Both groups have a falling F0 pattern at object-final level, but the Korean learners have a stronger, earlier fall, with a significant difference between groups at mid-point ($F(1,42) = 4{,}229$ $p=.0460$).

3.3. Declination line

The analyses of declination line (Table 2, Figure 3) show that all slopes are negative, which means that the global F0 progressively declines for all sentences. For all sentences, slopes of Korean L2 speakers of French are systematically lower than those of the French L1 speakers, which indicates that the declination is systematically stronger for French native speakers.

Table 1: Slopes of declination lines for the two groups of speakers.

Number of syllables per phrase	declination slopes for French speakers	declination slopes for Korean learners
1	-1,201	-0,722
2	-0,393	-0,377
3	-0,228	-0,187
4	-0,116	-0,110
5	-0,112	-0,080
6	-0,980	-0,690
7	-0,940	-0,048
8	-0,055	-0,032
9	-0,054	-0,029
10	-0,036	-0,025

Furthermore, for both groups, the longer the sentence is, the more the slope in absolute value decreases. This fact points out a diminution of the declination depending on the F0 target at the end of sentences, which is approximately constant. The Korean L2 speakers however seem to have a greater F0 amplitude around the declination line than the French speakers, which could be explained by differences in group size or a greater F0 modulation by Korean speakers. Further experimentation and more speakers could help understand these particular results.

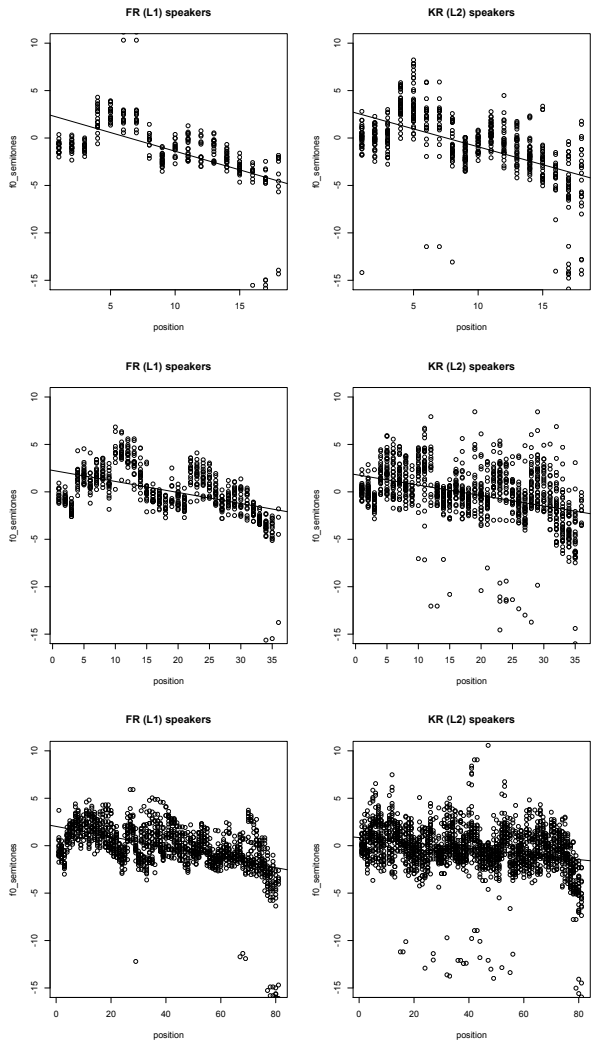

Figure 3: *Declination lines of the two groups for 3x2, 3x4 and 3x9 syllable sentences.*

4. Conclusion

For both French and Korean speakers, results of the present study reveal a systematic and strong lengthening of the subject-final vowels and the object-final vowels (i.e. sentence-final vowels) but not of the verb-final vowels as far the rhythmic component is concerned. In L2 productions however, systematic lengthening occurs at almost every final position. This vowel lengthening can also be observed in other positions in longer sentences, which reveals a different segmentation strategy in L2 speakers.

The analyses of phrase-final contours (subject, verb and object) show that French and Korean speakers have a similar subject and object-final realization of F0. However for L2 speakers, modulation of F0 appears to have a more random shape and height than for L1 speakers. Comparative analyses of declination lines through regression tests show a progressive decrease of F0 for both groups, with L1 speakers' declination being steeper than L2 speakers' declination. These differences in the production of L1 and L2 speakers in French are consistent with Jilka (2007) but are not sufficiently pronounced to precisely identify which of the four types of errors they represent. The prosodic similarity of the two languages in contact seems to be a criterion to consider in determining the types of errors. This result is confirmed by a perception study we conducted (Grandon & Yoo 2014) with native speakers of French, since these minor differences were not sufficient to allow the listeners perceiving a foreign accent in productions of French by Korean speakers.

5. Acknowledgements

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